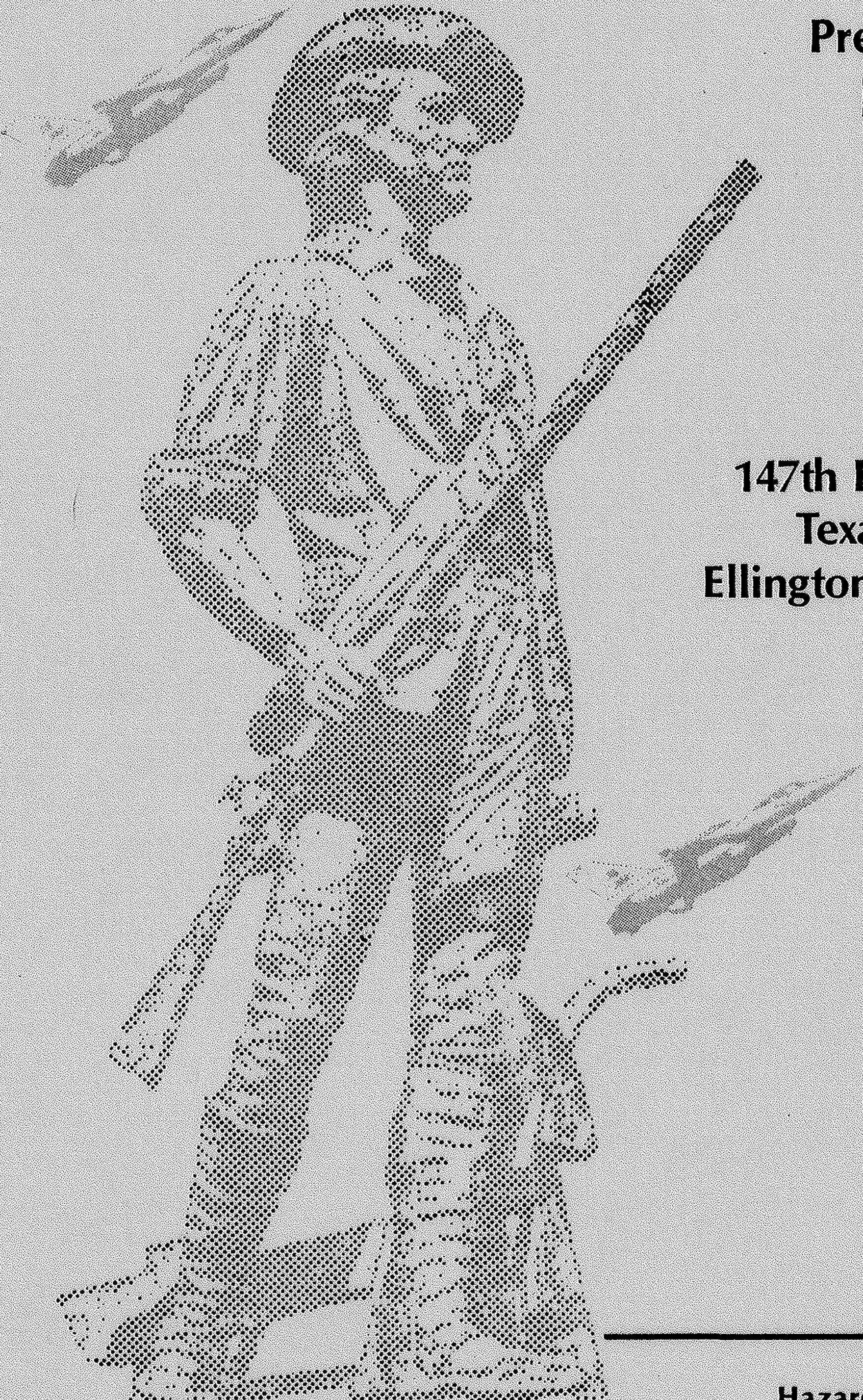
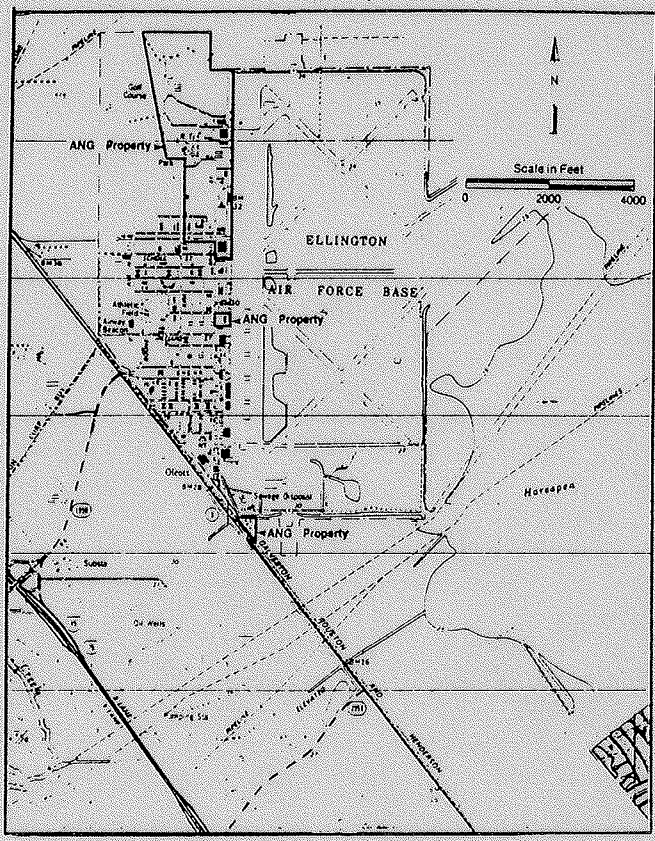
INSTALLATION RESTORATION PROGRAM



Preliminary Assessment
Records Search

147th Fighter Interceptor Group
Texas Air National Guard
Ellington Field Air National Guard
Houston, Texas

Hazardous Materials Technical Center
October 1987



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INSTALLATION RESTORATION PROGRAM
PRELIMINARY ASSESSMENT - RECORDS SEARCH FOR

147th FIGHTER INTERCEPTOR GROUP
TEXAS AIR NATIONAL GUARD
ELLINGTON FIELD AIR NATIONAL GUARD
HOUSTON, TEXAS

November 1987

Prepared for

National Guard Bureau
Washington, D.C. 20310

Prepared by

Hazardous Materials Technical Center
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Rockville, Maryland 20852

Contract No. DLA 900-82-4426

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EXECUTIVE SUMMARY

A. INTRODUCTION

The Hazardous Materials Technical Center (HMTC) was retained in December 1985 to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) - Records Search of the 147th Fighter Interceptor Group (FIG), Texas Air National Guard, Ellington Field Air National Guard Base, Houston, Texas, (hereinafter referred to as the Base), under Contract No. DLA-900-82-C-4426 (Records Search). The Records Search included:

- an onsite visit including interviews with six Base employees conducted by HMTC personnel during 11-12 December 1985;
- the acquisition and analysis of pertinent information and records on hazardous materials use and hazardous waste generation and disposal at the Base;
- the acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State and local agencies; and
- the identification of sites on the Base that may be potentially contaminated with hazardous materials/hazardous wastes (HM/HW).

B. MAJOR FINDINGS

The major operations of the 147th FIG that have used and disposed of HM/HW include aircraft maintenance; ground vehicle maintenance; and petroleum, oil, and lubricant (POL) management and distribution. Varying quantities of waste oils, recovered fuels, spent cleaners, strippers, and solvents were generated and disposed of by these activities.

Interviews with six Base personnel and a field survey resulted in the identification of three disposal and/or spill sites at the Base which existed prior to January 1984, or in the case of leaking tanks prior to February 1986; and which are potentially contaminated with hazardous materials. These sites are:

Site No. 1 - Former Base Landfill

Site No. 2 - POL Storage Area

Site No. 3 - Fuel System Repair Shop

One of the potentially contaminated hazardous waste sites (Site No. 1) was not numerically scored utilizing the Air Force Hazardous Assessment Rating Methodology (HARM) because there is no direct evidence that any HM/HW had been disposed of at the Former Base Landfill. However, based on experience with other Air Force Base IRP's, it is necessary to investigate these types of sites further to verify or refute the presence of HM/HW.

C. CONCLUSIONS

Two of the identified potentially contaminated hazardous waste sites have been further evaluated and given a Hazard Assessment Score (HAS) utilizing HARM:

Site No. 2 - POL Storage Area (HAS-64)

Two JP-4 fuel spills have occurred at this site. In 1973, an 8,000-gallon fuel spill occurred which flowed into an adjacent drainage ditch. In 1985, another 5,000-gallon fuel spill occurred; cleanup activities resulted in the recovery of all but approximately 200 gallons. Soil borings taken at this site in September 1985 indicated contamination.

Site No. 3 - Fuel System Repair Shop (HAS-53)

In November 1985, a 500-gallon waste fuel/oil leak consisting of PD-680, JP-4 and water occurred from an aboveground storage tank adjacent to the Fuel System Repair Shop. The spill was contained by booms and approximately 100 gallons were recovered by transferring the contained spill through an oil/water separator (OWS). Vegetative damage and discolored soil is visible at the site.

Because of the shallow aquifer system underlying the Base, the overall groundwater environment at Ellington Field is susceptible to contamination from surface contaminants; and therefore, these two sites should be further investigated in accordance with the IRP Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) process.

D. RECOMMENDATIONS

Because of the potential for contamination of groundwater at the Base, initial investigative stages of the IRP SI/RI/FS are recommended for the three sites that are potentially contaminated with HM/HW from past operations. The primary purposes of the subsequent investigations are as follows:

1. To determine whether pollutants are present at each site or determine that no pollutants are present, and

2. To determine whether groundwater at each site has been contaminated, and if it has, give quantification with respect to contaminant concentrations, the boundary of the contaminant plume, and the rate of contaminant migration.

I. INTRODUCTION

A. Background

The 147th Fighter Interceptor Group (FIG) is located at the Texas Air National Guard, Ellington Field Air National Guard Base, Houston, Texas (hereinafter referred to as the Base). The Base is located 25 miles southeast of the city of Houston and has been used by the Air National Guard (ANG) since 1955. Over the years, the types of military aircraft based and serviced here have varied, due to the change in mission of the 147th FIG. Both past and present operations have involved the use and disposal of materials and wastes that subsequently have been categorized as hazardous. Consequently, the ANG has implemented its Installation Restoration Program (IRP). The IRP consists of the following:

Preliminary Assessment (PA) - identifying past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.

Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) - acquiring data via field studies, for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment; preparing a Remedial Action Plan (RAP); and, if directed by the National Guard Bureau, preparing designs and specifications.

Research, Development and Demonstration (RD & D) - Technology Base Development (if needed) - developing new technology for accomplishment of remediation.

Remedial Design/Remedial Action (RD/RA) - Implementation of Site Remedial Action.

B. Purpose

The purpose of this IRP PA - Records Search (hereafter referred to as Records Search) is to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites on the Base. THe potential for migration of hazardous contaminants is evaluated by visiting the Base, reviewing existing environmental information, analyzing Base records concerning the use and generation of hazardous materials/hazardous waste (HM/HW), conducting interviews with past and present installation personnel who are familiar with past hazardous materials management activities, and making a physical inspection of the suspected sites. Relevant information collected and analyzed as a part of the Records Search included: Base history, with special emphasis on the history of the shop operations and their past HM/HW management procedures; local geological, hydrological, and meteorological conditions that may affect migration of contaminants; local land use, public utilities, and zoning requirements that could affect the potential for exposure to contaminants; and the ecological settings that indicate environmentally sensitive habitats or evidence of environmental stress.

C. Scope

The scope of this Records Search is limited to the Base and to spills, leaks, or disposal problems that occurred prior to January 1984 or, in the case of leaking tanks, prior to February 1986, and includes:

- An onsite visit;
- The acquisition of pertinent information and records on hazardous materials use and hazardous wastes generation and disposal practices at the Base;
- The acquisition of available geologic, hydrologic, meteorologic, land use and zoning, critical habitat, and utility data from various Federal, Texas State, and local agencies;
- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions.

The onsite visit, interviews with past and present personnel, and meetings with Federal, State, and local agency personnel were conducted during the period 11-12 December 1985. The HMTC Preliminary Assessment effort consisted of the following individuals (resumes are included as Appendix A):

- o Mr. Robert Paquette, Environmental Scientist
- o Mr. Timothy Gardner, Environmental Scientist
- o Mr. Mark Johnson, Geologist
- o Ms. Kathryn Gladden, Chemical Engineer

Individuals from the ANG who assisted in the Records Search included: Mr. Arthur Lee, Environmental Engineer, ANGSC/DEV; Lt. Colonel Michael Washeleski, Bioenvironmental Engineer, ANGSC/SGB; and selected members of the 147th FIG. The Base Point of Contact (POC) at the 147th FIG was Lt. Colonel Aloysius M. Stepchinski, Base Civil Engineer.

D. Methodology

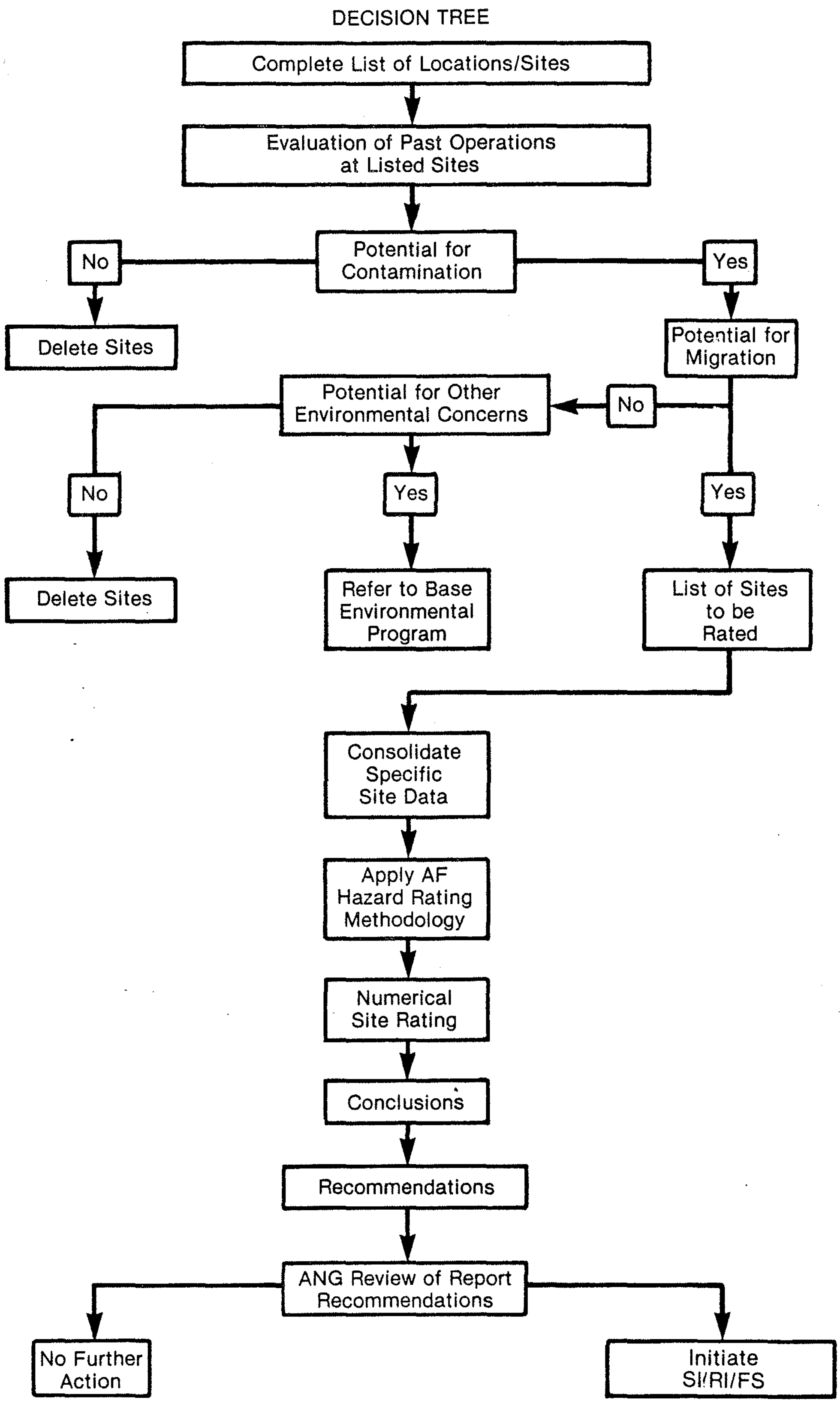
A flow chart of the Records Search Methodology is presented in Figure 1. This Records Search Methodology ensures a comprehensive collection and review of pertinent site specific information and is utilized in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The Records Search began with a site visit to the Base to identify all shop operations or activities on the installation that may have utilized hazardous materials or generated hazardous waste. Next, an evaluation of past and present HM/HW handling procedures at the identified locations was made to determine whether environmental contamination may have occurred. The evaluation of past HM/HW handling practices was facilitated by extensive interviews with six past and present employees familiar with the various operating procedures at the Base. These interviews were also utilized to define the areas on the Base where any waste materials, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or released into the environment.

HMTC

PRELIMINARY ASSESSMENT
INSTALLATION
RESTORATION PROGRAM

Figure 1.
Records Search Methodology Flow Chart.



Appendix B lists the interviewee's principle areas of knowledge and their years of experience with the Base. Historic records contained in the Base files were collected and reviewed to supplement the information obtained from interviews. Using the information outlined above, a list of past waste spill/ disposal sites on the Base were identified for further evaluation. A general survey tour of the identified spill/disposal sites, the Base, and the surrounding area was conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration. Particular attention was given to locating nearby drainage ditches, surface water bodies, residences, and wells.

Detailed geological, hydrological, meteorological, development (land use and zoning), and environmental data for the area of study was also obtained from appropriate Federal, State and local agencies as identified in Appendix C. Following a detailed analysis of all the information obtained, it was determined that the three identified sites were potentially contaminated with HM/HW; and the potential for groundwater contamination existed. Where sufficient information was available, sites were numerically scored utilizing the Air Force Hazardous Assessment Rating Methodology (HARM).

II. INSTALLATION DESCRIPTION

A. Location

The 147th FIG is located at the Texas Air National Guard, Ellington Field Air National Guard Base, in Harris County, approximately 25 miles southeast of the city of Houston, Texas.

The Base, which is situated 34 feet above sea level, is comprised of approximately 209 acres designated for exclusive use by the ANG. The runways are used jointly with the airport. Figure 2 shows the Base property covered by this Records Search.

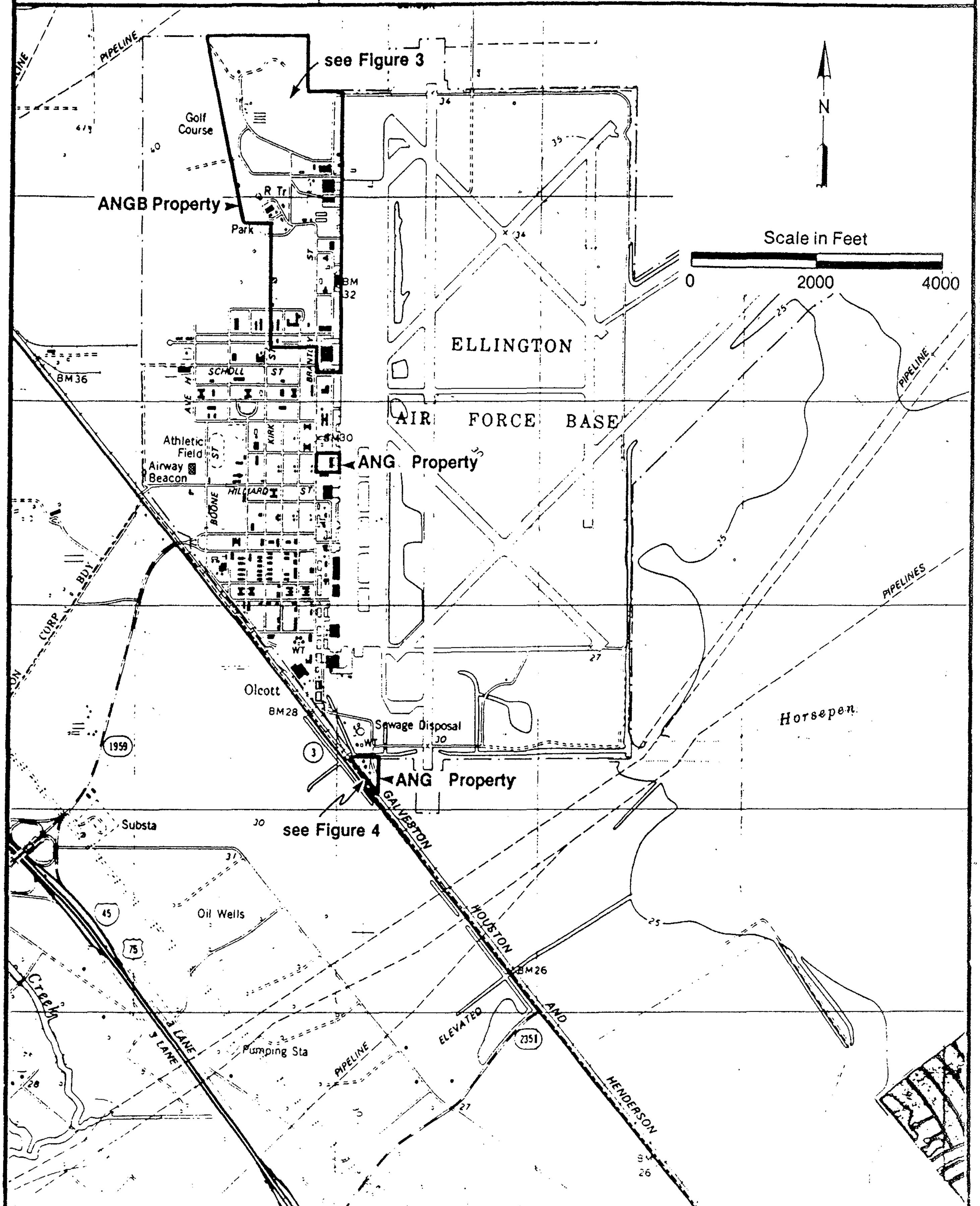
B. Organization and History

Ellington Air Force Base (AFB) was named in honor of a young Second Lieutenant, Eric L. Ellington, who was killed in the tangled wreckage of his flying machine near San Diego, California, on November 24, 1913. Construction of Ellington AFB (now Ellington Field) began on September 14, 1917. The first detachment of air service personnel, the 120th Aero Squadron, arrived on November 10, 1917. The first Base Commander, Col. Curry, arrived on November 27, and it was on that date that the first airplane was launched from the new airfield.

The Curtis JN-4 (Flying Jenny) was the first training-type airplane assigned to Ellington Field. Virtually every type of plane in the Air Force inventory has flown from Ellington AFB during the past half century, from the Flying Jenny to the most modern jets and NASA's "Super Guppy." Ellington has truly been the "Gateway to the Stars" through its pilot and navigator training programs, its gunnery and bombardment training. Today it is the home of proficiency training for United States astronauts, who fly the supersonic T-38 Talon. Ellington Air Force Base was inactivated on 31 March 1976 and is now operated by the 147th FIG and the Transition Caretaker Force.

Adapted from:
USGS 7½ Minute Quadrangle
Pasadena & Friendswood, Texas

Figure 2. Site Map of Texas ANG, Ellington Field Air National Guard Base, Houston, Texas.



The Texas ANG moved onto Ellington AFB in 1955. From its inception, the 147th FIG has been assigned a variety of missions; therefore, a variety of military aircraft have been based with them. The 147th FIG has mainly utilized the T-33, F-4C and C-131 aircraft.

III. ENVIRONMENTAL SETTING

A. Meteorology

Precipitation in Harris County, Texas, averages 44.77 inches annually. By calculating net precipitation according to the method outlined in the Federal Register (47 FR 31224, July 16, 1982) a net precipitation value of minus 8.23 inches per year is obtained. Rainfall intensity, based on 1 year, 24-hour rainfall, is 3.95 inches (calculated according to 47 FR 31235, July 16, 1982, Figure 8).

B. Geology

Harris County is in the Western Gulf section of the Coastal Plain. The uppermost formations, from which the parent materials of soils in the county weathered, are Pliocene, Pleistocene, and Holocene (Recent) in Age. These formations originally consisted of fluvial, deltaic, coastal marsh, and lagoonal soil materials and shallow sea deposits. Among the geologic and geomorphic features in the county are sedimentary deposits broken by normal faults, salt domes, pimple mounds, undrained depressions, and scarps.

The sedimentary deposits slope gently toward the Gulf of Mexico. They are broken by normal faults most of which dip toward the Gulf and extend downward many thousands of feet. The earth movements that caused these faults took place within the last 50,000 years. As Harris County has become urbanized, some of the faults have been reactivated, resulting in damage to pavement and houses. Also, as pumping has withdrawn large amounts of groundwater and lowered the artesian pressure in aquifers, the clay that enclosed the aquifers has dried and compacted. As the clay dried, especially in the areas adjacent to Galveston Bay, subsidence related to the faults took place and allowed flooding during periods of high tides and high winds.

The soils in this area are generally formed under grasses and are predominantly dark colored, loamy, and clayey. These prairie soils are nearly level,

IV. SITE EVALUATION

A. Activity Review

A review of installation records and interviews with past and present personnel at the Base resulted in the identification of specific operations within each activity in which the majority of industrial chemicals are handled and hazardous wastes are generated. Table 1 summarizes the major operations associated with each activity, provides estimates of the quantities of waste currently being generated by these operations, and describes the past and present disposal practices for the wastes. If an operation is not listed in Table 1, then that operation has been determined on a best-estimate basis to produce negligible quantities of wastes requiring ultimate disposal. For example, extremely small volumes of methyl ethyl ketone evaporate after use, and, therefore, do not present a disposal problem. Conversely, if a particularly volatile compound is listed, then the quantity represents an estimate of the amount actually disposed of according to the method shown.

B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

Interviews with six installation personnel (Appendix B) and subsequent site inspections resulted in the identification of three potentially contaminated waste disposal/spill sites. Of these three sites, it was determined that two of the sites are potentially contaminated with HM/HW with potential for migration. These two sites were scored using HARM (Appendix D). No direct evidence was obtained during the Records Search that HM/HW was disposed of in the other site. Figures 3 and 4 illustrate the locations of the scored/unscored sites. Copies of the completed Hazardous Assessment Rating Forms are found in Appendix E. Table 2 summarizes the Hazard Assessment Scores (HAS) for each of the scored sites. Brief descriptions of all the sites follow.

Table 1. Hazardous Waste Disposal Summary: Texas Air National Guard, Ellington Field Air National Guard Base, Houston, Texas

Shop Name	Building No.	Hazardous Waste/ Used Hazardous Material	Estimated Quantities (Gal./year)	Method of Treatment/Storage Disposal 1950 1960 1970 1980 Present
Organizational Maintenance	1382	JP-4	50	-----?-----|-----DPDO--------------►|--DRMO---►
		7808 Jet Engine Oil	20	-----?-----|-----DPDO--------------►|--DRMO---►
		Hydraulic Fluid	20	-----?-----|-----DPDO--------------►|--DRMO---►
		Paint Thinners	10	-----?-----|-----DPDO--------------►|--DRMO---►
Tire Shop	1282	Paint Stripper	110	-----?-----|-----DPDO--------------►|--DRMO---►
		PD680	55	-----?-----|-----DPDO--------------►|--DRMO---►
AGE Shop	1380	Engine Oil	330	-----?-----|-----DPDO--------------►|--DRMO---►
		PD680	55	-----?-----|-----DPDO--------------►|--DRMO---►
Engine Shop	1185	Engine Oil	330	-----?-----|-----DPDO---------------|--DRMO---►
		PD680	550	-----?-----|-----DPDO--------------►|--DRMO---►
Vehicle Maintenance	1357	Engine Oil	150	-----?-----|-----DPDO--------------►|--DRMO---►
		PD680	40	-----?-----|-----DPDO--------------►|--DRMO---►
		Sulfuric Acid	10	-----?-----|-----NEUTR--------------------------►
NDI Shop	1280	Magnaflux Zyglo #ZE-4B	300	-----?-----|-----DPDO--------------►|--DRMO---►
		Magnaflux Zyglo #ZP13A	330	-----?-----|-----DPDO--------------►|--DRMO---►

? - No information available
DPDO - Disposed of by Defense Property Disposal Office, Kelly Air Force Base
DRMO - Disposed of by Defense Reutilization and Marketing Office
NEUTR Neutralized and disposed of in the sewer system

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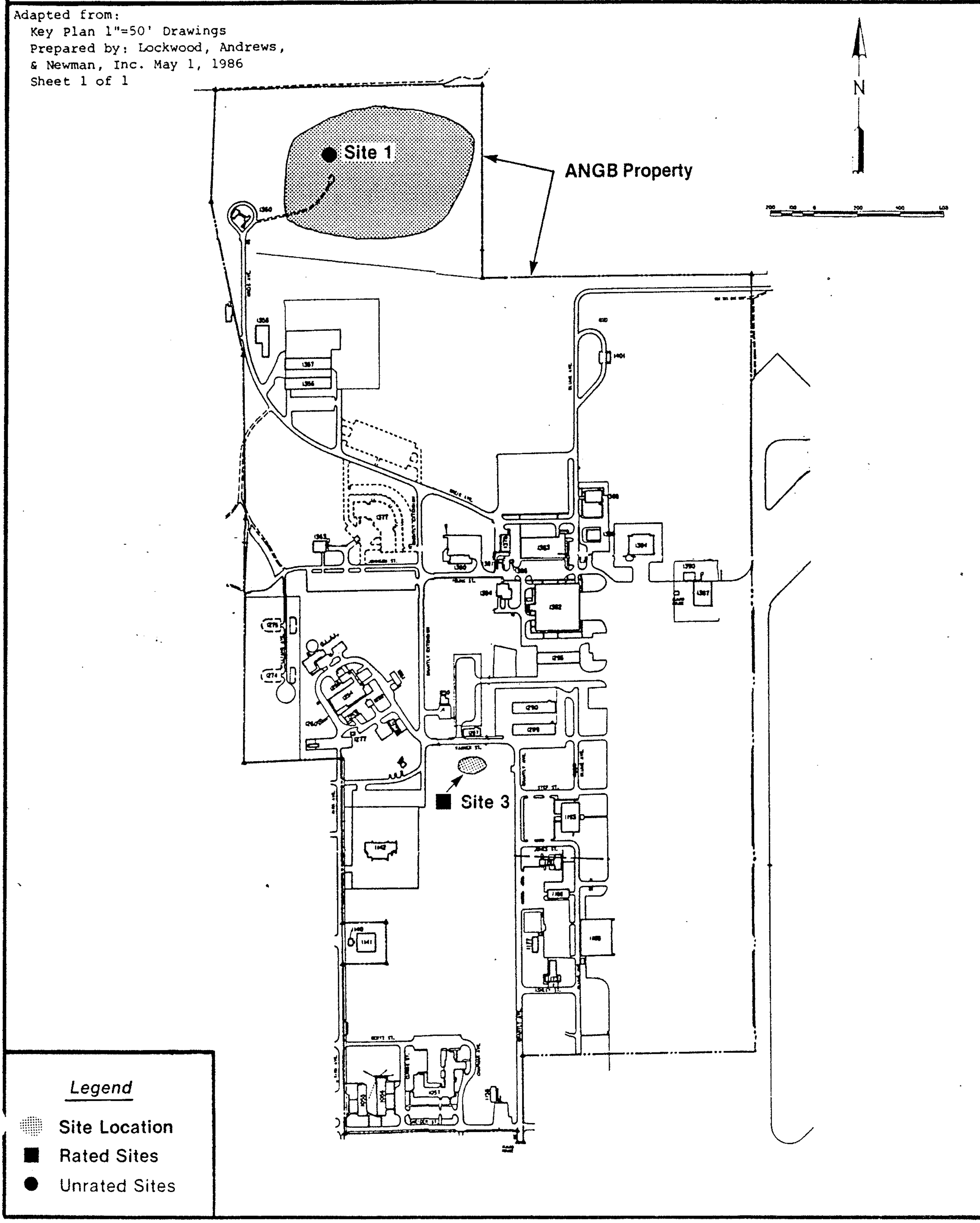
Location of Rated/Unrated Sites at Texas ANG, Ellington Field Air National Guard Base, Houston, Texas - Site No. 1 and Site No. 3

Figure 3



Location of Rated/Unrated Sites of Texas ANG, Ellington Field Air National Guard Base, Houston, Texas - Site No. 2

Figure 4.

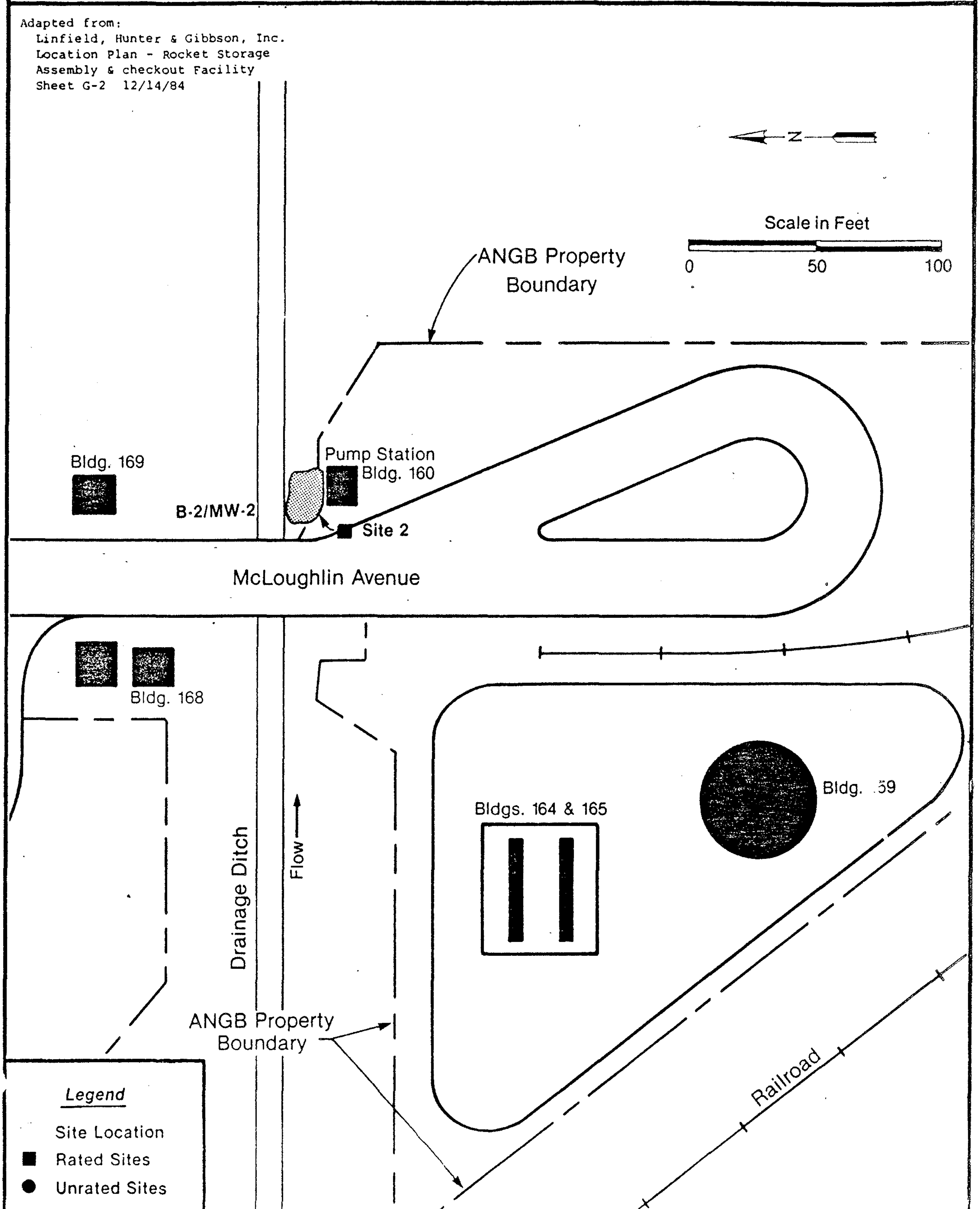


Table 2. Site Hazard Assessment Scores as derived from HARM: Texas Air National Guard, Ellington Field Air National Guard Base, Houston, Texas

Site Priority	Site No.	Site Description	Receptors	Waste Characteristics	Pathway	Waste Mgmt. Practices	Overall Score
1	2	POL Storage Area	59	80	52	1.0	64
2	3	Fuel System Repair Shop	56	50	52	1.0	53

Site No. 1 - Former Base Landfill (Unrated)

This area is located on the north end of the Base off Greig Avenue behind Buildings 1356 and 1357 (Figures 2 & 3). It was a major area of concern during the Records Search. The landfill which is on Base property was used by the ANG until 1974 and many different wastes were buried there. After reviewing all information presented during the Records Search it was determined that there is no direct evidence of any HM/HW being disposed of at this landfill. For example, soil borings taken at this site show only areas of common refuse (see Appendix F). There were no areas of accumulated drums or containers which would appear to have contained HM/HW, and there were no indications of chemical odors. Based on information provided, a Hazard Assessment Score (HAS) cannot be determined. However, based on experience with similar types of municipal landfills on military installations, additional investigations at this site are warranted and should be undertaken.

Site No. 2 - POL Storage Area (HAS-64)

This site is isolated from the main part of the Base and is located on the south end of Ellington Field off McLoughlin Avenue (Figures 2 & 4). The site is located within the POL storage and transfer area, which is surrounded by a chain link fence. The ANG property line is close to the fence. Two major JP-4 spills have occurred at this site. In 1973, an 8,000-gallon fuel spill occurred. Although attempts were made to contain the spill, most of the fuel reached an adjacent drainage ditch, which drains off ANG property. In October 1985, another JP-4 spill occurred in this same area. Although an estimated 5,000 gallons of fuel spilled, cleanup actions resulted in recovery of all but an estimated 200 gallons of fuel. Soil borings were taken in the POL storage area in September 1985. Although analysis for jet fuel indicated less than 500 ppm, soil boring results indicate strong "chemical odors" in two areas (see Appendix G for soil boring results). Because of the large volume of JP-4 spilled, observance of contaminated soil, chemical odor in the soil borings, and probable offbase migration of fuel because of close proximity of the property boundary, it was decided that a HAS and further study should be completed at this site.

Site No. 3 - Fuel System Repair Shop (HAS-53)

This site is near the north end of the Base, off Wagner Avenue adjacent to the Fuel System Repair Shop (Figures 2 & 3). In November 1985, a waste fuel/oil leak occurred from an outside aboveground storage tank. The tank contained waste PD-680, JP-4, and water at the time. The spill area was contained with booms and the area flooded with water. The entire volume collected was pumped into a tank truck and transported to Building 1380 where it was transferred to an oil/water separator. Approximately 100 of the original 500 gallons spilled were recovered. The spilled material flowed across an asphalt road and continued onto a grassy area and then into a drainage ditch system. Vegetative damage and discolored soil was observed in the area during the site visit.

In November 1985, soil sampling and analysis were conducted by ANG and Air Force Personnel as a result of the spill in this area. Analysis for volatile aromatics and volatile halocarbons indicated no contamination (Appendix H). However, due to the nature of volatile materials, there may have been no volatiles remaining in the samples by the time they were analyzed in January 1986. Also, the volatility of compounds in PD-680 is minimal, so by analyzing for volatiles, contamination by the compounds in PD-680 might have been overlooked. Due to the observable environmental stress, high water table in the area, and the fact that the spill reached the drainage ditch system, HARM evaluation was necessary.

C. Critical Habitats/Endangered or Threatened Species

According to Base personnel, there are no critical habitats nor endangered or threatened species of wildlife in the vicinity of the Base.

D. Other Pertinent Facts

- Base drinking water is supplied by municipal wells located on the south side of the main Base area. These municipal wells are drilled to a depth of approximately 550 feet below ground elevation (BGE) and screened at approximately 100 to 125 feet BGE.

- All oil/water separators are connected to the sanitary sewer system. Oil is collected by local oil reclaimers. Water is treated at the municipal sewage treatment plant located off of the Base on the south end of Ellington Field.

- There are no past or current Fire Training Areas on the Base. An Old Fire Training Area (OFTA) exists on Ellington Field. The OFTA is no longer in use and was never used by the ANG.

- There are no central hazardous waste storage areas on the Base. Hazardous waste is currently disposed of through the local DRMO. In the past, hazardous wastes were collected, along with the waste oils by the oil reclaimers.

- All nonhazardous waste generated at the Base is collected by a local refuse collection contractor and disposed of in a municipal landfill.

- There have never been any known leaks of PCB-contaminated oils from electrical transformers on the Base. All electrical transformers at the Base containing PCB have been removed and properly disposed of.

- There have been no known underground storage tank leaks at the Base.

- Waste oils have never been used for dust control on the Base.

- There have been no aircraft crashes on the Base resulting in a loss of fuel.

V. CONCLUSIONS

- o Because of the shallow aquifer system, the overall groundwater environment at the Base is susceptible to contamination from surface contaminants.

- o Information obtained through interviews with six Base personnel, review of Base records, and field observations has resulted in the identification of three potentially contaminated hazardous waste disposal and/or spill sites at the Base that existed prior to January 1984 or, in the case of leaking tanks, prior to February 1986. Two of the three sites (Site No. 2 - POL Storage Area, and Site No. 3 - Fuel System Repair Shop) are further scored using the Air Force HARM.

- o Although not scored, it is apparent that the other site (Site No. 1 - Former Base Landfill) will require some limited site investigation in order to confirm or refute the presence of any HM/HW at the site.

- o As a result of a field inspection, no evidence of offbase environmental stress from past waste disposal was observed in the immediate vicinity of the Base.

VI. RECOMMENDATIONS

Because of the potential for groundwater contamination at the Base, initial investigative stages of the IRP SI/RI/FS are recommended for the three sites that are potentially contaminated with HM/HW.

The primary purpose of the site-specific recommendations is to determine whether pollutants are present at each site. If pollutants are identified, the SI/RI/FS investigation should further determine whether groundwater at each site has been contaminated, and if it has, quantify the concentrations of contaminants and determine the boundary of the contaminant plume and rate of contaminant migration.

<u>Site No. 1 - Former Base Landfill</u>

Further IRP analysis is required at this site to determine if contamination exists.

<u>Site No. 2 - POL Storage Area</u>

Further IRP analysis at this site is required to determine the extent of the soil contamination and to determine if groundwater has been contaminated.

<u>Site No. 3 - Fuel System Repair Shop</u>

Further IRP analysis at this site is required to determine if contamination exists.

GLOSSARY OF TERMS

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

CONTAMINANT - As defined by Section 101(f)(33) of SARA shall include, but not be limited to any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CRITICAL HABITAT - The native environment of an animal or plant which, due either to the uniqueness of the organism or the sensitivity of the environment, is susceptible to adverse reactions in response to environmental changes such as may be induced by chemical contaminants.

DOWNGRADIENT - A direction that is hydraulically downslope; the direction in which groundwater flows.

ENDANGERED SPECIES - Wildlife species that are designated as endangered by the U.S. Fish and Wildlife Service.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, 11 December 1981.

HAS - Hazard Assessment Score - The score developed by utilizing the Hazardous Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration,, or physical, chemical, or infectious characteristics may:

a. cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or

b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HYDRAULIC GRADIENT - The rate of change in total head per unit of distance of flow in a given direction.

MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

POROSITY - The percentage of the bulk volume of a rock or soil that is occupied by interstices, whether isolated or connected.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

THREATENED SPECIES - Wildlife species who are designated as "Threatened" by the U.S. Fish and Wildlife Service.

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and manmade features.

WATER TABLE - The upper limit of the portion of the ground wholly saturated with water.

WETLANDS - An area subject to permanent or prolonged inundation or saturation that exhibits plant communities adapted to this environment.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

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Appendix A
Resumes of Preliminary Assessment Team Members

ROBERT J. PAQUETTE

EDUCATION

B.S., environmental science, University of New Hampshire, 1973

EXPERIENCE

Extensive experience in hazardous waste receiving, handling, storage, and property accounting. Designed a system of labeling hazardous material/waste for proper storage. Developed Part B Application Information for many hazardous waste facilities. Conducted training sessions in hazardous materials/waste including receiving/warehousing, storage compatibility and personal safety. Performed atmospheric sampling for all major pollutants, computer modeling research projects and surveillance of possible regional air pollution sources.

EMPLOYMENT

Dynamac Corporation (1984-present): Environmental Scientist

Presently working on Installation Restoration Program for Air National Guard. Also, wrote State-of-the-Art Procedures for Defense Supply Depots concerning compatibility, Packing, Packaging, Spill Response, and Recoupment of hazardous materials and waste.

Defense Reutilization and Marketing Region, Defense Depot Ogden (1981-1984): Environmental Protection Specialist

Provided daily property disposal guidance to DPDOs concerning receiving, handling, storage and property accounting of HM/HW; provided technical advice on the handling and disposal of HM/HW to field personnel at DPDOs in region. Interpreted State and Federal regulations for superiors and the DPDOs, and acted as liaison between field personnel and State/Federal environmentalists. Assisted in rewriting DOD environmental regulations. Trained DPDO personnel in all aspects of HM/HW procedures as part of their increasingly involved environmental mission; wrote Emergency Response and Spill Contingency Plans. Developed Part B applications for HW facilities. Conducted environmental audits at DPDOs and other D.O.D. facilities.

State of New Hampshire, Bureau of Solid Waste Management (1979-1981): Environmental Specialist

Responsible for all work activities dealing with uncontrolled hazardous waste sites. Working knowledge of safety equipment, personal protection equipment, safety plans, and monitoring, sampling and analytical procedures relating to hazardous waste. Daily contact with industry and the general public discussing current New Hampshire and Federal hazardous waste regulations. Assisted in developing regulations and interpreting existing regulations. Conducted research regarding proper disposal of hazardous waste materials; determining if certain materials are considered hazardous. Conducted inspections of industry to insure compliance with the Federal hazardous waste regulations (RCRA). Daily interaction with the U.S. Environmental Protection Agency.

State of New Hampshire, Air Resource Agency (1978-1979): Environmental Specialist

Assisted in conducting the research for and the development of the State Implementation Plan for New Hampshire; conducted computer modeling research projects and was partly responsible for Atmospheric Dispersion Modeling of Meteorology for the State of New Hampshire which included written and verbal reports. Knowledge of N.E.S.H.A.P. and N.H. Air Resource Regulations.

State of New Hampshire, Air Resource Agency (1974-1978): Air Pollution Technician

Responsible for atmospheric sampling for all major pollutants; site determination and development maintenance of air pollution monitors; air pollution monitoring and meteorology; chart data reduction; written reports; surveillance of all possible air pollution sources in district; inspections of most industries in district; constant public contact with county and city officials as well as the general populace; complaint investigations; occasional dissertations to private and public organizations.

TIMOTHY N. GARDNER

Environmental Scientist

EDUCATION

M.A., Environmental Biology, Hood College
B.S., Forestry/Resource Management, West Virginia University

EXPERIENCE

Mr. Gardner has five years of technical experience in environmental control and research, with emphasis on risk assessment, chemical safety, radiation safety, hazardous waste management (chemical and radiologic), and activated carbon filtration research. His past responsibilities include site risk assessment, chemical and radioactive waste pickup and storage for disposal at a large cancer research facility, and chemical and radioactive spill control, as well as safety surveys and technical assistance in activated carbon desorption research.

EMPLOYMENT

Dynamac Corporation (1984-Present): Staff Scientist

At Dynamac, Mr. Gardner's responsibilities include site surveys and record searches for the Phase I portion of the Installation Restoration Program (IRP) for various Air National Guard Bases. Efforts include risk assessment, site prioritization, and remedial action recommendations. He has also been a contributing author for a closure-post closure plan for a hazardous waste landfill at Clovis AFB, plans and specifications for the removal of asbestos at several Air Force White Alice sites in Alaska, and the update and revision of a DLA regulation for "Disposal of Unwanted Radioactive Material."

NCI-Frederick Cancer Research Facility (1981-1984): Lab Technician

Mr. Gardner worked in radiation and chemical safety as well as environmental research. His responsibilities included monitoring personal and environmental air quality at work areas where free iodinations occurred, monitoring work areas and equipment for isotope contamination, periodic surveys to monitor compliance with NCR safety regulations, isotope inventory control, transfer of isotopes between licenses, and periodic calibration and maintenance of survey instruments. He was also responsible for radioactive and chemical waste pickup and storage for disposal, and served as an advisor for safety-related matters pertinent to radiation and radioactive waste, chemical safety, and industrial hygiene. In the environmental research division, he was s involved in activated carbon desorption studies involving the use of analytic laboratory equipment.

PROFESSIONAL AFFILIATIONS

American Tree Farm Association
Hardwood Research Council
West Virginia Forestry Association

MARK D. JOHNSON

EDUCATION

B.S., geology, James Madison University, 1980

EXPERIENCE

Six years' technical experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance and preparation of statements of work for the Air Force and the Air National Guard.

EMPLOYMENT

Dynamac Corporation, HMTC (1984-present): Staff Scientist/Geologist

Primarily responsible for preparing statements of work for Phase IV-A of the Air Force's Installation Restoration Program, statements of work for Phase II and Phase IV-A of the Air National Guard's Installation Restoration Program, and assessing groundwater of hazardous waste disposal/spill sites on military installations for the purpose of determining rates and extents of contaminant migration and for developing remedial investigations and identifying remedial actions. Prepared guidance document for the Air Force's Installation Restoration Program.

Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists
National Water Well Association/Association of Ground Water Scientists
and Engineers
British Tunneling Society

KATHRYN A. GLADDEN

EDUCATION

B.S., chemical engineering (minor in biological sciences), University of Washington, 1978

SECURITY CLEARANCE

Secret DOD clearance

EXPERIENCE

Seven years of experience in hazardous waste consulting and plant process engineering. Experience includes development of engineering alternatives for reduction of in-plant effluents and preparation of RCRA background listing documents for the plastics industry.

EMPLOYMENT

<u>Dynamac Corporation (1985-present)</u>: Staff Engineer

Performs studies on the feasibility of solvent recycling, including the evaluation of several alternatives. Studies to date have included 15 sites. For each site, prepared reports describing present practice for solvent use and disposal, and conducted economic analyses of options.

Conducted preliminary site investigations and ranking of hazardous waste sites for the U.S. Federal Bureau of Prisons. Prepared reports detailing site investigation findings and recommendations for Phase II monitoring and sampling.

Preparing statement of work for a Phase IV-A remedial action plan for the Air Force's Installation Restoration Program.

Conducted analysis of public comments on Advanced Notice of Public Rulemaking to establish National Primary Drinking Water Regulations for radionuclide contaminants.

<u>Peer Consultants (1984-1985)</u>: Staff Engineer

Developed background documents for listing of RCRA hazardous wastes.

<u>Engineering Science (1983-1984)</u>: Staff Engineer

Conducted regulatory policy review and technology assessment of transportation and decontamination procedures for acutely hazardous wastes. Project engineer for development of a cost analysis methodology for the U.S. Army Toxic and Hazardous Materials Agency Installation Restoration Program.

Weyerhaeuser Company (1978-1983): Chemical Engineer

Conducted plant environmental audits to develop in-plant effluent load balances; developed capital alternatives and improved operating procedures for in-plant effluent reduction; developed and implemented recommendations for plant energy conservation and process optimization programs; investigated industrial hygiene impacts of wood pyrolysis air emissions, and performed pilot trials for wood gasification and pyrolysis technology development.

PROFESSIONAL AFFILIATIONS

Tau Beta Pi Engineering Honorary
Society of Women Engineers

Appendix B
Interviewee Information

INTERVIEWEE INFORMATION

Interviewee Number	Primary Duty Assignment	Years Associated with Texas ANG
1	Civil Engineering	30
2	Civil Engineering	14
3	Operations and Maintenance	33
4	Supply Operations	33
5	Bioenvironmental Engineering	3
6	Production Control Operations	13

Appendix C
Outside Agency Contact List

OUTSIDE AGENCY CONTACT LIST

1. Federal Emergency Management Agency
   Flood Map Distribution Center
   6930 (A-F) San Tomas Road
   Baltimore, Maryland 21227-6227

2. Texas Parks and Wildlife Department
   6120 Highway 290, West
   Austin, Texas 78746

3. United States Geological Survey
   12201 Sunrise Valley Drive
   Reston, Virginia 22092

Appendix D
USAF Hazard Assessment Rating Methodology

USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

> develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air National Guard in setting priorities for follow-on site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: possible receptors of the contamination, the waste and its characteristics, the potential pathways for contamination migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors category rating is based on four rating factors: the potential for human exposure to the site, the potential for human ingestion of contaminants should underlying aquifers be polluted, the current and anticipated uses of the surrounding area, and the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1,000 feet of the site, and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows: receptors subscore = (100 x factor score subtotal/ maximum score subtotal).

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways: surface-water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no containment are not reduced. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factory to the sum of the scores for the other three categories.

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE ______

LOCATION ______

DATE OF OPERATION OR OCCURRENCE ______

OWNER/OPERATOR ______

COMMENTS/DESCRIPTION ______

SITE RATED BY ______

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to installation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
Subtotals			______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
Subtotals			______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 X factor score/3) ______

3. Ground water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
Subtotals			______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-15	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

o Verbal reports from interviewer (at least 2) or written information from the records

o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

o No verbal reports or conflicting verbal reports and no written information from the records

o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level
- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating
- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B.1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($>10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall	<1.0 inch	1.0 to 2.0 inches	2.1 to 3.0 inches	>3.0 inches	8
(Thunderstorms)	0-5 0	6-35 30	36-49 60	>50 100	

B.2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B.3 Potential for Ground-Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to + 20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8

B-3 Potential for Ground-Water Contamination--Continued

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-6-3, then leave blank for calculation of factor score and maximum possible score.

CNR122

Appendix E
Site Hazardous Assessment Rating Forms

147th Fighter Interceptor Group
Texas Air National Guard
Ellington Field Air National Guard Base
Houston, Texas

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

1. RECEPTORS

Population within 1,000 feet of site:

Site No. 2	One to 25
Site No. 3	Greater than 100

Distance to nearest well:

Site No. 2	Less than 3,000 feet
Site No. 3	

Land use/zoning with 1 mile radius:	Commercial or Industrial

Distance to installation boundary:

Site No. 2	Zero to 1,000 feet
Site No. 3	Zero to 1,000 feet

Critical environments within 1 mile:	Not a critical environment.
Water quality of nearest surface water body:	Agricultural or industrial use
Population served by surface water supply within 3 miles downstream of site:	Zero

2. WASTE CHARACTERISTICS

Quantity:

Site No. 2	Greater than 20 tons
Site No. 3	Five to 20 tons

Confidence Level:

Site No. 2	Confirmed confidence level
Site No. 3	Confirmed confidence level

Hazard Rating:

Site No. 2	Medium
Site No. 3	Medium

147th Fighter Interceptor Group
Texas Air National Guard
Ellington Field Air National Guard Base
Houston, Texas

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria (Continued)

2. WASTE CHARACTERISTICS (Continued)

Persistence:

Site No. 2	Metals, polycyclic, and halogenated compounds
Site No. 3	Metals, polycyclic, and halogenated compounds

Physical State

Site No. 2	Liquid
Site No. 3	Liquid

3. PATHWAYS

Surface Water Migration

Distance to nearest surface water:	Zero to 500 feet
Net precipitation:	Less than 10 inches per year
Surface erosion:	None
Surface permeability:	10^{-4} to 10^{-6} cm/sec
Rainfall intensity:	Greater than 5.0 inches

Flooding: Beyond 100-year floodplain

Groundwater Migration

Depth to groundwater:	Zero to 10 feet
Net precipitation:	Less than 10 inches per year
Soil permeability:	Greater than 10^{-6} cm/sec
Subsurface flow:	Occasionally submerged
Direct access to groundwater:	Low risk

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 2-POL STORAGE AREA

LOCATION TEXAS AIR NATIONAL GUARD, ELLINGTON FIELD AIR NATIONAL GUARD BASE, HOUSTON, TEXAS

DATE OF OPERATION OR OCCURRENCE 1973, 1985

OWNER/OPERATOR 147th Fighter Interceptor Group, Texas Air National Guard

COMMENTS/DESCRIPTION Site isolated from main base - soil borings strong chemical odors

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	106	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C - confirmed, S - suspected) C
3. Hazard rating (H - high, M - medium, L - low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 1.0 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

HAZARDOUS ASSESSMENT RATING FORM

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			56	108

Subscore (100 X factor score subtotal/maximum score subtotal) 52

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 X factor score/3) 0

3. Ground water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	1	8	8	24
Direct access to ground water	1	8	8	24
Subtotals			54	114

Subscore (100 X factor score subtotal/maximum score subtotal) 47

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors 59
Waste Characteristics 80
Pathways 52

Total 191 divided by 3 = 64
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

64 x 1.0 = $\boxed{64}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 3 - FUEL SYSTEM REPAIR SHOP

LOCATION TEXAS AIR NATIONAL GUARD, ELLINGTON FIELD AIR NATIONAL GUARD BASE, HOUSTON, TEXAS

DATE OF OPERATION OR OCCURRENCE November 1985

OWNER/OPERATOR 147th Fighter Interceptor Group, Texas Air National Guard

COMMENTS/DESCRIPTION

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	101	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 56

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C - confirmed, S - suspected) C
3. Hazard rating (H - high, M - medium, L - low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 = 50

HAZARDOUS ASSESSMENT RATING FORM

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	56	108

Subscore (100 X factor score subtotal/maximum score subtotal) 52

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 X factor score/3) 0

3. Ground water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	1	8	8	24
Direct access to ground water	1	8	8	24
		Subtotals	54	114

Subscore (100 X factor score subtotal/maximum score subtotal) 47

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	56
Waste Characteristics	50
Pathways	52

Total 158 divided by 3 = 53 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

53 x 1.0 = 53

Appendix F
Logs of Soil Test Borings; Former Base Landfill

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE-GRAINED SOILS MORE THAN HALF IS SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

KEY TO TEST DATA

Consol — Consolidation	Tx	320	(2600)	Unconsolidated Undrained Triaxial	
LL — Liquid Limit (in %)	TxCU	320	(2600)	Consolidated Undrained Triaxial	
PL — Plastic Limit (in %)	DS	2750	(2000)	Consolidated Drained Direct Shear	*
PI — Plasticity Index (in %)	FVS	470		Field Vane Shear	
G_s — Specific Gravity	UC	2000		Unconfined Compression	
SA — Sieve Analysis	LVS	700		Laboratory Vane Shear	
▬ — "Undisturbed" Sample					
⊠ — Bulk Sample					
◫ — Sample attempted with no recovery					
#-200 — % Fines passing #200 sieve					

Numbers: Shear Strength, psf — (Confining Pressure, psf)

All strength tests on 2.8" or 2.4" diameter samples unless otherwise indicated.

*indicates 1.4" diameter sample.

NOTES

These Notes Are Applicable To All Boring and/or Test Pit Log Plates in This Report.

1. Elevation 100' = Project Datum = El 36.24' USC & GS Datum. Boring and test pit elevations determined from preliminary topographic survey be J.B. Hostetler Engineering Co., Inc., undated.

2. Blows/foot = Standard Penetration Test (N) value.

3. Torvane values are approximations of soil undrained shear strength.

Harding Lawson Associates Engineers Geologists & Geophysicists	SOIL CLASSIFICATION CHART & KEY TO TEST DATA ROCKET FACILITY ELLINGTON AFB HOUSTON, TEXAS	PLATE A1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	6277,001.12	Pull	1/82		

Equipment Rotary Wash

Elevation 101 feet   Date 12-17-81

Laboratory Tests	Torvane (ksf)	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)
	1.0				0
	>2.0				
					5
					10
		10			
					15
		14			
					20
		15			25
					30
					35
					40

Sample

DARK GRAY SILTY CLAY (CL)
medium stiff to stiff, moist, with roots in upper 6"

GRAY-BROWN CLAY (CL)
stiff, wet

LIGHT BROWN CLAYEY SANDY SILT (ML)
saturated, medium stiff to stiff
brown at 13'

BROWN SILTY SAND (SM)
medium dense, saturated

Groundwater level not determined

Harding Lawson Associates
Engineers, Geologists & Geophysicists

LOG OF BORING B-1
ROCKET FACILITY
ELLINGTON AFB, TEXAS

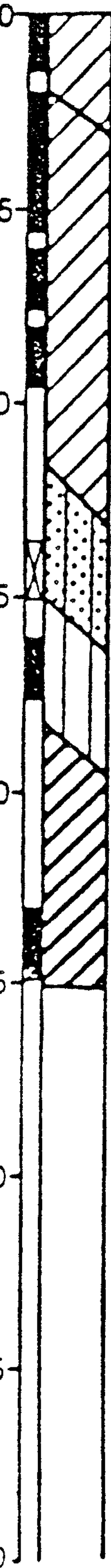
PLATE A2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	6277,001.12	[illegible]	1/82		

Equipment Rotary Wash

Elevation 101 feet Date 12/18/81

Laboratory Tests	Torvane (ksf)	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)
	>2.0		16.5	108	0
	1.2		21.4	101	
LL=38 PL=18 PI=20 -200=57%					5
	1.3		19.3	110	
			21.8	105	
					10
					15
					20
	>2.0				
					25
					30
					35
					40



DARK GRAY SILTY CLAY (CL)
stiff, moist, with organic matter within upper 12"

LIGHT BROWN SANDY CLAY (CL)
stiff, saturated, with calcareous nodules

BROWN SILTY SAND (SM)
medium dense, saturated

BROWN CLAYEY SILT (ML)
medium stiff, saturated

RED CLAY (CH)
very stiff, saturated

Groundwater level not determined

Harding Lawson Associates
Engineers, Geologists & Geophysicists

LOG OF BORING B-2
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	6277,001.12	PMJ	1/82		

Equipment Rotary Wash

Elevation 100 feet Date 12-17-81

Laboratory Tests	Torvane (ksf)	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	Description
LL=37 PL=20 PI=17 -200=73%					0		DARK GRAY SILTY CLAY (CL) stiff, moist, with roots within upper 12"
	1.4						GRAY-BROWN CLAY (CL) medium stiff to stiff, wet with calcareous nodules at 3.5'
	>2.0				5		
							GRAY-BROWN CLAYEY SILT (ML) medium stiff, saturated
					10		sandy at 9'
							silty sand lenses
					15		
					20		BROWN SILTY SAND (SM) dense, saturated
		35			25		Groundwater level not determined
					30		
					35		
					40		

Harding Lawson Associates
Engineers Geologists
& Geophysicists

LOG OF BORING B-3
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE
A4

Equipment Rotary Wash

Elevation 100 feet Date 12-18-81

Laboratory Tests	Torvane (ksf)	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)
	>2.0		16.7	111	0
	>2.0		21.9	103	
Tx1900(500)	1.9		15.5	114	5
Tx1500(600)			19.8	107	
					10
					15
					20
					25
					30
					35
					40

DARK GRAY SILTY CLAY (CL)
stiff, moist, with roots within upper 12"

BROWN AND GRAY SANDY CLAY (CL)
very stiff, wet with calcareous nodules

BROWN SANDY SILT (ML)
stiff, saturated

BROWN SILTY SAND (SM)
medium dense, saturated with clay layers

RED CLAY (CH)
very stiff, saturated

Groundwater level not determined

Harding Lawson Associates
Engineers Geologists
& Geophysicists

LOG OF BORING B-4
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A5

LOG OF Test Pit TP-1

Equipment: Backhoe
Elevation: 102 feet Date: 12/18/81

Column headings: Laboratory Tests | Blows/foot | Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

Laboratory Tests:
LL=34
PL=18
PI=16
-200=76%

Depth (ft)	Description
0	GRAY SILTY CLAY (CL) stiff, moist, with roots in upper 9"
	GRAY BROWN CLAY (CL) stiff, moist
5	
	No free water encountered
10	

LOG OF Test Pit TP-2

Equipment: Backhoe
Elevation: 100 feet Date: 12/18/81

Depth (ft)	Description
0	GRAY CLAY (CL) stiff, moist, with roots in upper 6"
	BROWN CLAY (CL) stiff, wet
5	
	No free water encountered
10	

LOG OF Test Pit TP-3

Equipment: Backhoe
Elevation: 99 feet Date: 12/18/81

Depth (ft)	Description
0	GRAY SILTY CLAY (CL) medium stiff to stiff, moist, with roots in upper 12"
	LIGHT GRAY CLAY (CL) stiff, moist
5	
	No free water encountered
10	

Harding Lawson Associates
Engineers Geologists & Geophysicists

LOG OF TEST PIT TP-1,2,3
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	6[illegible].001.12	[illegible]	1/82		

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample

LOG OF Test Pit TP-4

Equipment Backhoe

Elevation 99 feet Date 12-18-81

0

GRAY CLAY (CL)
medium stiff, wet with roots

DARK GRAY SILTY CLAY (CL)
stiff, moist,

5

No free water encountered

10

LOG OF Test Pit TP-5

Equipment Backhoe

Elevation 98 feet Date 12-18-81

0

GRAY SILTY CLAY (CL)
stiff to medium stiff, wet, with roots

GRAY AND BROWN CLAY (CL)
stiff, moist

5

No free water encountered

10

LOG OF Test Pit TP-6

Equipment Backhoe

Elevation 98 feet Date 12-18-81

0

DARK GRAY SILTY CLAY (CL)
soft, wet, with roots

GRAY CLAY (CL)
stiff moist

BROWN CLAY (CL)
stiff, moist

5

No free water encountered

10

Harding Lawson Associates
Engineers Geologists
& Geophysicists

LOG F TEST PIT TP-4,5,6
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE
A7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	6277,001.12	DWC	1/82		

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample

LOG OF Test Pit TP-7

Equipment Backhoe

Elevation 102 feet Date 12-18-81

Depth (ft): 0, 5, 10

GRAY SILTY CLAY (CL)
medium stiff to stiff, moist, with roots in upper 6"

BROWN CLAY (CL)
stiff, moist

No free water encountered

LOG OF Test Pit TP-8

Equipment Backhoe

Elevation 100 feet Date 12-18-81

Depth (ft): 0, 5, 10

DARK GRAY SILTY CLAY (CL)
medium stiff, moist, with roots in upper 6"

GRAY-BROWN SILTY CLAY (CL)
stiff, moist

No free water encountered

LOG OF Test Pit TP-9

Equipment Backhoe

Elevation 99 feet Date 12-18-81

Depth (ft): 0, 5, 10

DARK GRAY SILTY CLAY (CL)
medium stiff, moist, with roots in upper 12"

GRAY SANDY CLAY (CL)
stiff, moist

No free water encountered

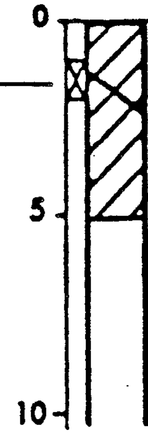
Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample

LOG OF Test Pit TP-10

Equipment Backhoe

Elevation 98 feet   Date 12-18-81

LL=43
PL=16
PI=27
-200=83%



DARK GRAY SILTY CLAY (CL)
medium stiff, moist, with roots in the upper 4"

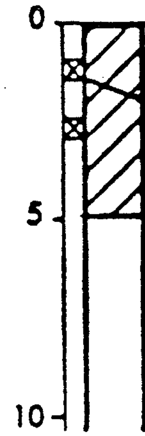
GRAY-BROWN SANDY CLAY (CL)
stiff, moist

No free water encountered

LOG OF Test Pit TP-11

Equipment Backhoe

Elevation 97 feet   Date 12-18-81



DARK GRAY SILTY CLAY (CL)
medium stiff, moist, with roots in the upper 4"

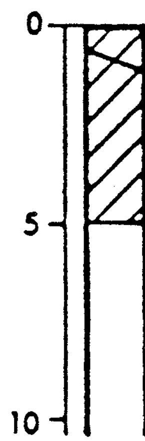
GRAY SANDY CLAY (CL)
stiff, moist

No free water encountered

LOG OF Test Pit TP-12

Equipment Backhoe

Elevation 100 feet   Date 12-18-81



DARK GRAY SILTY CLAY (CL)
stiff, moist, with roots in upper 6"

RED AND BROWN CLAY (CL)
very stiff, moist

No free water encountered

Harding Lawson Associates
Engineers, Geologists & Geophysicists

LOG OF TEST PIT TP-10,11,12
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	6277,001.12	DWC	1/82		

Laboratory Tests | Blows/foot | Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

LOG OF Test Pit TP-13

Equipment Backhoe

Elevation 99 feet Date 12-18-81

0

GRAY SILTY CLAY (CL)
stiff, moist, with roots in upper 6"

GRAY AND BROWN CLAY (CL)
stiff, moist
No free water encountered

5

10

LOG OF Test Pit TP-14

Equipment Backhoe

Elevation 99 feet Date 12-18-81

0

DEBRIS FILL (concrete block, plastic rubber & other commercial waste) with bad odor

seepage at 4'

FILL

5

10

LOG OF Test Pit TP-15

Equipment Backhoe

Elevation 101 feet Date 12-18-81

0

DEBRIS FILL (large concrete blocks and other wastes)

FILL

GRAY CLAY (CL)
very stiff, moist

5

No free water encountered

10

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Engineers Geologists
& Geophysicists

LOG OF TEST PIT TP-13,14,15
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A10

DRAWN TLP | JOB NUMBER 6577,001.12 | APPROVED | DATE 1/82 | REVISED | DATE

Laboratory Tests | Blows/foot | Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

LOG OF Test Pit TP-16

Equipment: Backhoe

Elevation: 103 feet   Date: 12-18-81

Depth (ft)	Description
0	Top soil with concrete blocks
	DEBRIS FILL (commercial wastes, boards, plastic) with odor seepage at 4' — FILL
5	
10	

LOG OF Test Pit TP-17

Equipment: Backhoe

Elevation: 100 feet   Date: 12-18-81

Depth (ft)	Description
0	GRAY SILTY CLAY (CL) stiff, moist, with roots in upper 12
	BROWN CLAY (CH) stiff, moist
5	No free water encountered
10	

LOG OF Test Pit TP-18

Equipment: Backhoe

Elevation: 100 feet   Date: 12-18-81

Depth (ft)	Description
0	LIGHT GRAY SILTY CLAY (CL) stiff, moist, with roots in upper 12'
5	No free water encountered
10	

Harding Lawson Associates
Engineers Geologists & Geophysicists

LOG OF TEST PIT TP-16, 17, 18
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A1

DRAWN TJP | JOB NUMBER 5077,001.12 | APPROVED | DATE 1/82 | REVISED | DATE

Laboratory Tests | Blows/foot | Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

LOG OF Test Pit TP-19

Equipment Backhoe

Elevation 101 feet   Date 12-18-81

0
SHELL PAVEMENT   FILL

BROWN CLAY (CL)
stiff, moist

5
No free water encountered

10

LOG OF Test Pit TP-20

Equipment Backhoe

Elevation 103 feet   Date 12-18-81

0
SHELL PAVEMENT
DEBRIS FILL   FILL
GRAY-BROWN CLAY (CL)
stiff, moist

5
No free water encountered

10

LOG OF Test Pit TP-21

Equipment Backhoe

Elevation 101 feet   Date 12-18-81

0
DEBRIS FILL (soil, glass, concrete block)   FILL

BROWN CLAY (CL)
very stiff, moist

5
No free water encountered

10

Harding Lawson Associates
Engineers, Geologists & Geophysicists

LOG OF TEST PIT TP-19,20,21
ROCKET FACILITY
ELLINGTON AFB, TEXAS

A12

TLP   6277,001.12   1/82

Laboratory Tests | Blows/foot | Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

LOG OF Test Pit TP-22

Equipment Backhoe

Elevation 101 feet Date 12-18-81

0

DEBRIS FILL (wastes, oily water, concrete block, glass, wood)

seepage below 3.5' FILL

BROWN CLAY (CL)
stiff, wet

5

10

LOG OF Test Pit TP-23

Equipment Backhoe

Elevation 102 feet Date 12-18-81

0

DEBRIS FILL (plastic bags, woods, concrete)

seepage at 3' FILL

BROWN AND GRAY SANDY CLAY (CL)
stiff, wet

5

10

LOG OF Test Pit TP-24

Equipment Backhoe

Elevation 100 feet Date 12-18-81

0

GRAY SILTY CLAY (CL)
stiff, moist, with roots in upper 6"

BROWN AND GRAY SANDY CLAY (CL)
stiff, wet
water level (12-18-81)

5

10

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample

LOG OF Test Pit PT-25

Equipment Backhoe

Elevation 100 feet Date 12-18-81

0

GRAY SILTY CLAY (CL)
stiff, moist, with roots in upper 4"

BROWN SANDY CLAY (CL)
stiff, moist

5

No free water encountered

10

LOG OF Test Pit TP-26

Equipment Backhoe

Elevation 101 feet Date 12-18-81

0

GRAY SILTY CLAY (CL)
medium stiff, moist

BROWN SILTY SANDY CLAY (CL)
stiff, moist

5

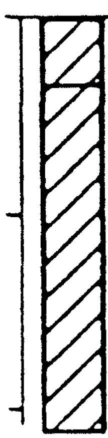
No free water encountered

10

LOG OF Test Pit TP-27

Equipment Backhoe

Elevation 101 feet Date 12-18-81



0

GRAY-BROWN SILTY CLAY (CL)
medium stiff, moist, with some glass fragments — FILL

GRAY-BROWN SILTY CLAY (CL)
stiff, moist

5

sandy below 6'

10

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

LOG OF TEST PIT TP-25,26,27
ROCKET FACILITY
ELLINGTON AFB, TEXAS

PLATE A14

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
TLP	5277,001.12	DW	1/82		

Appendix G
Logs of Soil Borings;
POL Storage Area

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

222 Cavalcade St. • P.O Box 8768. Houston. Texas 77249 • 713/692-9151

October 2, 1985

Re: Jet Fuel Concentration
ANG Fuel Farm
Ellington Field
Houston, Texas
SWL No. 85-302

147th Fighter Interceptor Group
Texas Air National Guard
Bldg. 160, Ellington Field
Houston, Texas 77034-5586
Attn: Milton Hamon

Gentlemen:

Attached please find the results of the testing for jet fuel concentration in soil samples taken at Ellington Field for the above referenced project. These services were authorized under Purchase Order No. DAHA41-85-W-2139.

The soil samples were obtained by drilling a soil boring to a depth of 19 feet below grade near the southeast bridge abutment adjacent to the ANG Fuel Farm at Ellington Field in Houston, Texas. The boring location was determined by representatives of the 147th FIG. The boring was advanced by flight auger and samples were obtained by pushing thin walled "Shelby Tubes" into the ground at the selected depths.

A copy of the soil boring log and a Key Symbol Sheet describing the symbols used on the log are also attached.

If you have any questions or if we can be of further service, please contact us.

Sincerely,

SOUTHWESTERN LABORATORIES

Edward D. Prost, Jr.
Geotechnical Engineering Division

Joseph Ray Meyer, P.E.
Manager
Geotechnical Engineering Division

EDP kt

SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

222 Cavalcade St. • P.O. Box 8768, Houston, Texas 77249 • 713/692-9151

File No.

Report No. 5704-5707

Report Date 10/1/85

Client: 147th Fighter Interceptor Group
Texas Air National Guard
Bldg. 160, Ellington Field
Houston, Texas 77034-5586
Attn: Milton Hamon

Project: Analysis of soil samples for jet fuel. Geotechnical project no. 85-302. Sample received 9/23/85.

RESULTS

Sample I.D.	SWL Lab No.	ppm Jet Fuel
Jet Fuel	5704	N/A - used as standard
#1 4-6'	5705	<500
#2 8-10'	5706	<500
#3 17-19'	5707	<500

SOUTHWESTERN LABORATORIES

Technician:

Copies 3 - SWL/Geotechnical - Ed Prost

pm

Chris Barr
Chemist

LOG OF BORING B-1

PROJECT: Hydrocarbon Testing, ANG Fuel Farm, Ellington Field, Houston, Texas
Project No. 85-302

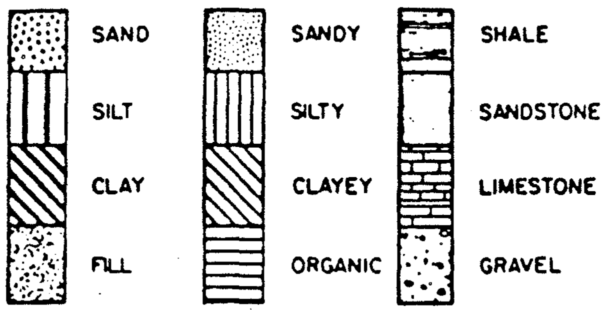
DATE: 9-23-85 TYPE: Soil Test Boring LOCATION:

▼ WATER ▮ SAMPLE ⊠ STANDARD PENETRATION

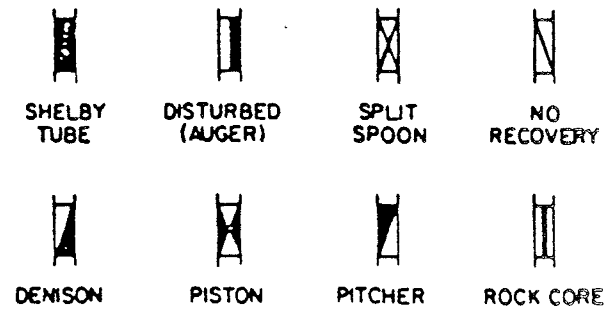
DEPTH, FEET	SYMBOL	SAMPLES	BLOWS PER FT.	DESCRIPTION SURFACE ELEVATION:
0				Stiff gray clay with chemical odor
5				
10				- color change to light gray and tan, with calcareous and ferrous nodules
15				
				Stiff red-brown silty clay with chemical odor
20				Boring Terminated at 19 feet

KEY TO SOIL CLASSIFICATION TERMS AND SYMBOLS

SOIL OR ROCK TYPES



SAMPLER TYPES



CONSISTENCY OF COHESIVE SOILS
(MAJOR PORTION PASSING NO. 200 SIEVE)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH, KIPS/SQ FOOT
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.5
FIRM	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

RELATIVE DENSITY OF GRANULAR SOILS
(MAJOR PORTION RETAINED ON NO. 200 SIEVE)

DESCRIPTIVE TERM	RELATIVE DENSITY, %
VERY LOOSE	LESS THAN 15
LOOSE	15 TO 35
MEDIUM DENSE	35 TO 65
DENSE	65 TO 85
VERY DENSE	GREATER THAN 85

WATER LEVELS

▽ - GROUNDWATER LEVEL AFTER 24 HOURS (UNLESS OTHERWISE NOTED)

▼ - DEPTH GROUNDWATER FIRST ENCOUNTERED DURING DRILLING

TERMS DESCRIBING SOIL STRUCTURE

Parting:	paper thin in size.
Seam:	1/8" - 3" in thickness
Layer:	greater than 3" in thickness
Calcareous:	containing appreciable quantities of calcium carbonate.
Ferrous:	containing appreciable quantities of iron
Well-Graded:	having wide range in grain size & substantial amounts of all intermediate sizes.
Poorly Graded:	predominately one grain size or having a range of sizes with some intermediate sizes missing
Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical
Interbedded:	composed of alternate layers of different soil types
Laminated:	composed of thin layers of varying color and texture.
Slickensided:	having inclined planes of weakness that are slick & glossy in appearance
NOTE:	Clays possessing slickensided or fissured structure may exhibit lower unconfined strength than indicated above. Consistency of such soil is interpreted using the unconfined strength along with pocket penetrometer results

Appendix H
Soil Analysis Results;
Fuel System Repair Shop

LABORATORY ANALYSIS

TO	FROM USAF OEHL/SA Brooks AFB TX 782355501

SAMPLE IDENTITY	DATE RECEIVED
Water	24 JAN 86
SAMPLE FROM	LAB CONTROL NR

TEST FOR
Volatile Aromatics

Methodology: EPA 8020

OEHL NO:	5076	5078			Detection Limit	
BASE NO:	GS860005	GS860003			ND	TR
Benzene	ND	ND			0.5	1.0
Chlorobenzene					0.5	1.0
1,2-Dichlorobenzene					0.5	1.0
1,3-Dichlorobenzene					0.5	1.0
1,4-Dichlorobenzene					0.5	1.0
Ethylbenzene					0.5	1.0
Toluene					0.5	1.0
m-xylene						
o-xylene						
p-xylene						

Results in PPM

ND-None Detected. Less than the detection limit.
TRACE-Present but less than the quantitative limit.

DATE ANALYZED: Not Reported

Edward J. Brown
05 MAR 1986

ANALYSIS COMPLETED BY CONTRACT LAB

REQUESTING AGENCY (Mailing Address)
147 USAF CLN/SGPB
510 Ellington Field
Houston, TX. 77034-5586

Atch 1

FROM USAF OEHL/SA
BROOKS AFB TX 78235 -5508-

SAMPLE IDENTITY	DATE RECEIVED
ATER	24 JAN 86
SAMPLE FROM	LAB CONTROL NR

TEST FOR
Volatile Halocarbons

Methodology: EPA Method 8010

OEHL NO:	5075	5077				DET.
CASE NO:	GS860004	GS860002				LIMIT
Bromodichloromethane	ND	ND				0.05
Bromoform						0.05
Bromomethane						0.05
Carbon Tetrachloride						0.05
Chlorobenzene						0.05
Chloroethane						0.05
2-Chloroethylvinyl ether						0.05
Chloroform						0.05
Chloromethane						0.05
Dibromochloromethane						0.05
1,2-Dichlorobenzene						0.05
1,3-Dichlorobenzene						0.05
1,4-Dichlorobenzene						0.05
Dichlorodifluoromethane						0.05
1,1-Dichloroethane						0.05
1,2-Dichloroethane						0.05
1,1-Dichloroethene						0.05
ans-1,2-Dichloroethene						0.05
1,2-Dichloropropane						0.05
cis-1,3-Dichloropropene						0.05
trans-1,3-Dichloropropene						0.05
Methylene Chloride						0.05
1,1,2,2-Tetrachloroethane						0.05
Tetrachloroethylene						0.05
1,1,1-Trichloroethane						0.05
1,1,2-Trichloroethane						0.05
Trichloroethylene						0.05
Trichlorofluoromethane						0.05
Vinyl Chloride						0.05

Results in PPM

DATE ANALYZED: Not Noted ON Report

ANALYSIS COMPLETED BY CONTRACT LAB

Edward J. Brown
05 MAR 1986

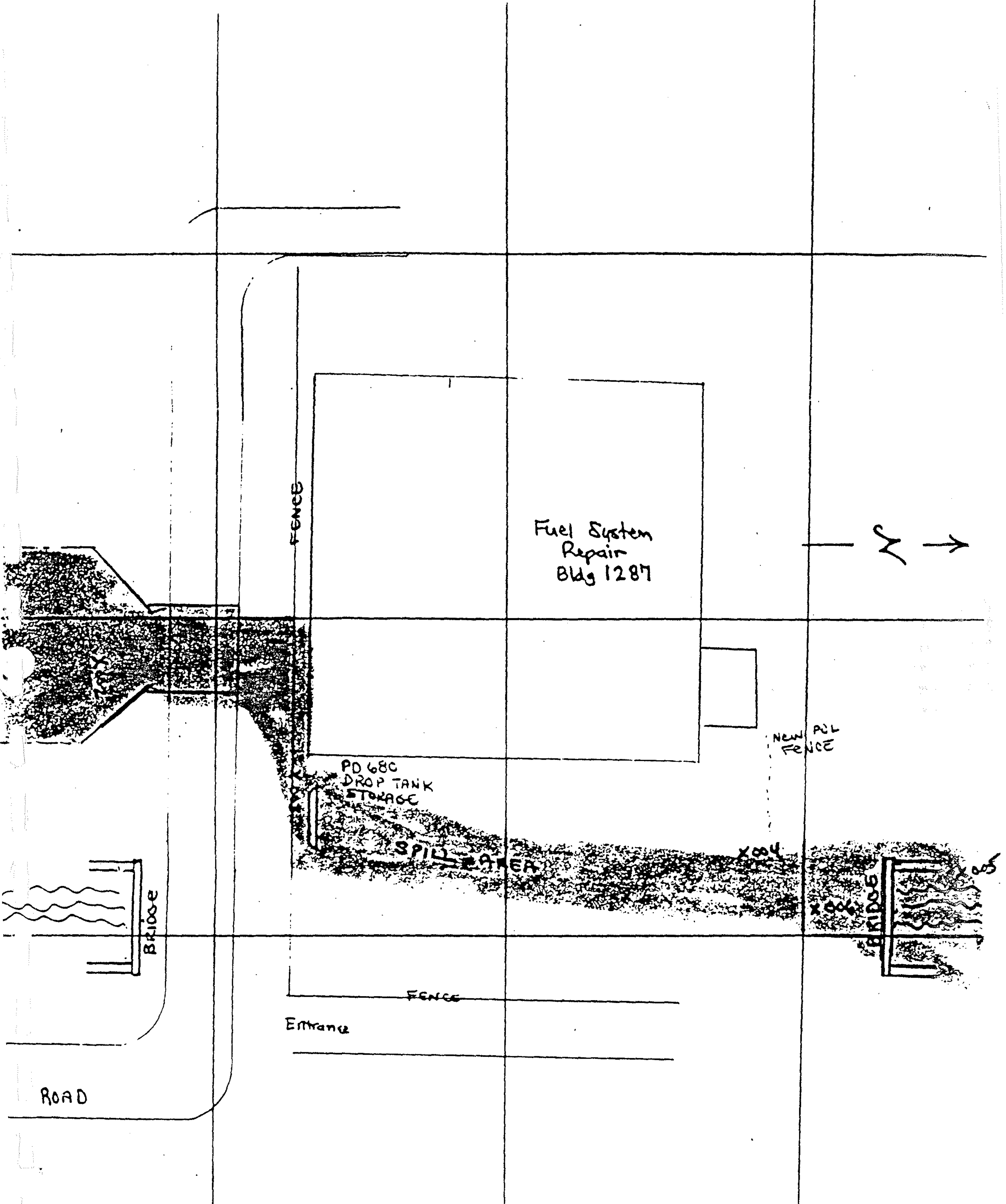
REQUESTING AGENCY (Mailing Address)

147 USAF CLN/SGPB
510 Ellington Field
Houston, TX 77034-5586

ND-NONE DETECTED, LESS THAN THE DETECTION LIMIT.

TRACE-PRESENT BUT LESS THAN THE QUANTITATIVE LIMIT
TRACE = 2 times Detection Limit.

AMD FORM 641 REPLACES OEHL FORM 7, DEC 78, WHICH IS OBSOLETE.



* SOIL SAMPLES TAKI
AS A RESULT OF
POLLUTION INCIDE
TSG Simpson/...

...ch 2